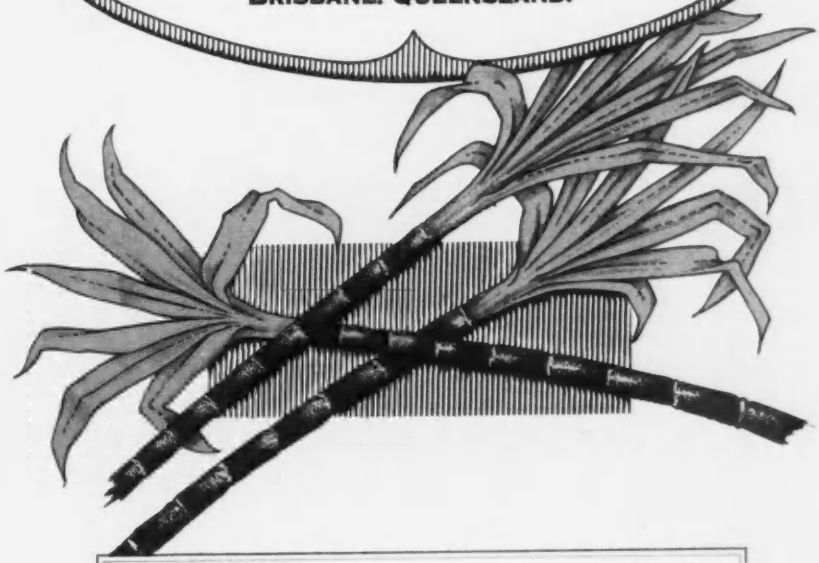
DEPARTMENT OF AGRICULTURE AND STOCK.

The CANE GROWERS' QUARTERLY BULLETIN

ISSUED BY
BUREAU OF SUGAR EXPERIMENT STATIONS
BRISBANE. QUEENSLAND.



VOL. VI. No. 1. 1 JULY, 1938.

Contents.

SOUTHERN CANE GRUBS.
GREEN MANURE CROPS.
PESTS BOARDS CONFERENCE.
SHEEP GRAZING TRIALS AT MACKAY.
NUT GRASS ERADICATION.
MOSAIC DISEASE.
FIELD DAY ADDRESSES, BUNDABERG.

BUREAU OF SUGAR EXPERIMENT STATIONS
BRISBANE

THE CANE GROWERS' QUARTERLY BULLETIN

ISSUED BY DIRECTION OF THE
HON. F. W. BULCOCK, MINISTER
FOR AGRICULTURE AND STOCK

1 JULY, 1938

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CONTENTS.

	Page.
Cane Grub Control in the Isis District, by R. W. Mungomery ..	1
Poona Pea as a Green Manure Crop	2
Cane Pests Destruction Boards, Annual Conference	5
Grub Control in the Burdekin District, 1937-38, by H. G. Knust ..	7
French's Cane Beetle, by J. H. Buzacott	8
The Beetle Borer, by J. H. Buzacott	9
Fiji and Downy Mildew Diseases	11
Protecting Roofs of Farm Buildings	11
Sheep Grazing and Lamb Raising Trials at Mackay, by D. L. McBryde and H. W. Kerr	12
Nut Grss Eradication	15
Mosaic Disease of Sugar Cane, by C. W. Leece	16
Cane Samples for Test Purposes at Experiment Stations ..	19
An Experiment in Soaking of Cane Plants, by N. J. King	19
Need for Lime on Acid Soils	21
A New Green Manure Crop, by N. J. King	21
Special Fertilizer Mixtures for Sugar Cane, by H. W. Kerr ..	23
Bundaberg Field Day—Address by H. W. Kerr	25
P.O.J. 2878 in Southern Queensland—Can it be Retained? by A. F. Bell	27
Downy Mildew Disease, by A. F. Bell	30

The
Cane Growers' Quarterly
—Bulletin—

VOL. VI | 1 JULY, 1938 | No. 1

Cane Grub Control in the Isis District.

By R. W. MUNGOMERY.

WHILST investigating the progress of the Giant American Toad in the Isis district in the early part of the present year, attention was paid to the cane grub pest and, although no detailed survey could be carried out in the time available, it seemed evident that the pest had not increased markedly (if at all), over the general infestation of previous years. Odd patches of grub-damaged cane were to be seen in various localities, and grubs were even bad in paspalum pasture land where they had killed out patches of grass, but this has been a feature of previous infestations too; the standover crops do not appear, as yet, to have given the pest any great impetus to increase abnormally. However, the standing over of crops and longer ratooning, and their general effect on the increase of the grub pest, will have to be watched carefully over a number of years to ensure that these practices are not unduly influencing the building up of denser grub populations. Where grubby patches occur in ratoon blocks of cane, growers are warned against the practice of allowing this cane to stand over, since the combined influence of both grubs and dry weather often reduce the final yield much below the tonnage which could have been harvested if the block had been cut as a normal one-year crop.

It is pleasing to note that some of the larger estates, which in previous years suffered such heavy and widespread infestations, are now comparatively free of the pest. It is true that patches of grubs occur from time to time in different blocks, but the infestation is not on such a huge scale as previously. This changed status of the grub pest appears to be due to the system of using the high-speed rotary hoe and eliminating spring planting. When blocks are being prepared for planting they are given two high-speed rotary-hoeings during summer months, when the majority of the grubs are located in the upper soil levels. To get the maximum benefit from these operations it is best to carry out this work when the soil is reasonably moist. These two operations should also be spaced at an interval of six weeks to two months in order to ensure that any grubs which are below the depth to which the implement works on the first occasion, will almost assuredly lie within its range at the second working, when they move up near to the surface. Dry soil conditions tend to make the grubs retire deeper in the soil, hence the undesirability of carrying out this work when the

soil is in that state. After the first rotary-hoeing a grubber can sometimes be worked through the block with advantage, as this allows the hoes of the implement to cut more deeply during the second operation.

These operations account for a large percentage of grubs and, when planted to cane in February or thereabouts, the block then starts off with a very low grub population and, in typical grub-infested areas, it can usually be expected to remain reasonably free of the pest until the second ratoon crop.

Such a system of grub control, involving the use of expensive tractor equipment, was necessarily limited in previous years to those large plantations which could afford such heavy overhead expenses as this equipment involves. However, we understand that a high-powered unit now operates in the Isis district on contract work and although we have not had the opportunity of checking the grub mortality behind this machine, reports indicate that it is much in advance of the ordinary type rotary hoe commonly used by growers.

The more widespread adoption of this form of grub control seems to be a definite forward move and it has much to commend it over the more tedious, costly, and less efficient method of single furrow ploughing and hand-picking.

Poona Pea as a Green Manure Crop.

THE Poona pea belongs to that class of legumes commonly known as "cowpeas" and more particularly to the *catjang* or Indian cowpea group. The origin of the name "Poona" is obscure; this is not used overseas, but it appears probable that the introduction was made from Poona in India and that the term was used to describe this particular variety of cowpea. It was introduced into Queensland a good many years ago and in later years has enjoyed a remarkable rise to favour as a green manure crop in North Queensland. At the present time in the far north it is probably planted to a greater area than the combined areas of all other green manure crops. The reasons for this expansion are—(1) the small cost of seed, one bushel costing approximately 15s. being ample for the broadcast seeding of 3-4 acres; (2) quick and certain germination; (3) ability to produce a heavy crop on poorer lands.

Although the Poona pea may take longer to attain maturity than, say, the Groit bean or the black cowpea, nevertheless it must be regarded as a quick maturing crop and may usually be ploughed in some 10-12 weeks after planting. It is a prolific seeder and for that reason must be ploughed in when the seeds are in the milk stage, otherwise some trouble may be experienced later.

The Poona pea is rich in protein and makes an excellent stock food either cut and fed green or when stored as hay; it is widely used by dairy farmers in Southern Queensland. We have not had much experience of the ratooning of this crop but have observed several instances of excellent ratoons being produced; for this purpose it would appear necessary to cut the crop early, before the first seed has set. In some

instances the plant crop has been used for fodder and the ratoon crop ploughed in for green manure purposes. (See Fig. 1.)

Unfortunately this otherwise excellent plant is rather susceptible to a wilt disease which attacks it in wet weather. The stem of affected plants starts to discolour and wilt a few inches above ground level; the infection then extends down to the roots and the plant eventually dies. This wilt spreads very rapidly in the wet season and a whole planting may be destroyed in a short time. Although it generally commences in the wettest portions of fields its spread appears to be mainly dependent upon continued wet weather and it has been observed on every type of soil, including well drained hillsides. In areas where this wilt persistently occurs it would be advisable to plant the Groit bean or the giant, black, or victor cowpea.

Fig. 1.—Poona pea grown on the farm of F. J. E. Holt, The Cedars, Mackay. The three plants on the left represent the plant crop, and the three on the right the ratoon crop from portion of this plant crop. The older plant crop plants have naturally become woody and defoliated, but it will be seen that the ratoon plants have grown better even with the shorter growth period.

As in the case with all legumes, Poona pea has the faculty of working in association with nitrogen-fixing bacteria and obtaining its supplies of nitrogen from the air and not from the soil. Consequently when such a crop is ploughed in the nitrogen content of the soil is considerably enriched. These nitrogen-fixing bacteria carry out their work in small nodules attached to the roots of the growing plant. It should be pointed out that these bacteria will not carry on with nitrogen fixation if there is plenty of nitrate available in the soil and thus no additional stocks of nitrogen will be accumulated. From this point of view therefore it is desirable to plant the green manure soon after harvesting and ploughing out, when the nitrate supplies of the field are low. By the same token it should be borne in mind that if

nitrates are plentiful it is possible to grow an excellent crop of Poona pea without the formation of a single nodule—but in such a case all the nitrogen will have come from the soil and not from the air.

Particular strains of these nitrogen-fixing bacteria are specific to particular groups of plants while, in addition, one strain may be much more efficient than another strain which works in the same plant. Consequently, in order to ensure that efficient strains will be present in the soil, modern agricultural practice aims at the planting of suitably inoculated seeds of legumes. In Fig. 2 will be seen the advantage gained from the inoculation of Poona pea with a highly efficient strain of bacteria as compared with a less efficient strain. Cultures of this efficient strain

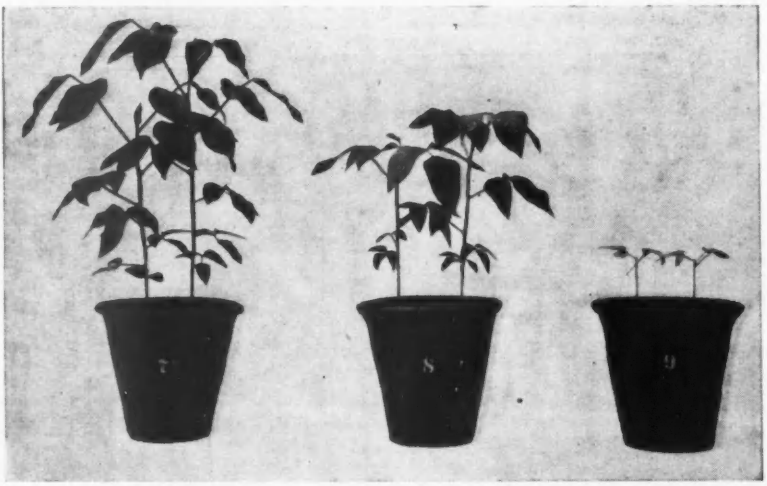

Fig. 2.—Poona Pea plants grown in sterilized sand. No. 7 inoculated with a good strain of nitrogen-fixing bacteria. No. 8 medium strain, No. 9 not inoculated.

are maintained in our Pathology Laboratory in Brisbane and can be made available to cane growers at a nominal charge. Application, accompanied by a postal note or stamps to the value of 1s., should be made to the Director, Bureau of Sugar Experiment Stations, Brisbane, at least three weeks before the proposed planting; in making such applications the weight of seed to be planted should be furnished. The process of seed inoculation is very simple and rapid, and full instructions will be issued with each culture.

A. F. B. and G. B.

Cane Pests Destruction Boards—Annual Conference.

THE fourth annual conference of representatives of Cane Pests Destruction Boards was held at the Sugar Experiment Station, Meringa, on 25th May, 1938, and was attended by delegates from all parts of Northern and Central Queensland, as follows:—

Mossman—Messrs. A. R. Rex and J. P. Reynolds.

Hambledon—Messrs. J. G. L. Gillett, John Mann, L. J. Boden, and C. L. Richardson.

Mulgrave—Messrs. W. C. Griffin and M. A. Doolan.

Babinda—Messrs. W. M. Simmonds and W. J. Ryan.

Goondi—Mr. K. W. Maclean.

South Johnstone—Messrs. G. Wilson and P. Scassola.

Mourilyan—Messrs. J. Valmadre, E. H. Fox, and H. W. Wyndham.

Tully—Messrs. J. A. Winter and A. R. Taylor.

Macknade—Messrs. H. Smith and K. R. Gard.

Victoria—Messrs. E. D. Row and D. G. Smith.

Invicta (Ingham Line)—Messrs. E. R. Marshall and T. G. Peebles.

Invicta (Giru)—Mr. W. J. Nelson.

Kalamia—Mr. A. H. Nuttall.

Pioneer—Mr. M. T. Norris.

Inkerman—Messrs. H. V. Hansen and H. J. Ramsden.

Mackay—Messrs. R. Clarke and J. J. Headrick.

Plane Creek—Mr. E. H. Atherton.

Bureau of Sugar Experiment Stations—Messrs. A. F. Bell, R. W. Mungomery, J. H. Buzacott, W. A. McDougall, C. G. Hughes, and H. G. Knust.

Mr. W. C. Griffin, Mulgrave, was voted to the chair and conducted the day's proceedings.

A number of short papers dealing with various aspects of pest control were delivered to Conference and a very considerable and sustained discussion followed. It is indicative of the value of such Conferences that the technical standard of the discussions has improved very considerably each year. A selection from these papers is presented in the following pages.

As might be expected, a great deal of interest centred around the control of the northern cane grub. The subject was introduced by the reading of a paper entitled "Grub Control, Burdekin District, 1937-8," by H. G. Knust (*see* p. 7) and a request from the Victoria Pests Board that the Conference discuss the advisability of catching beetles as a means of control of this pest. After must discussion a motion was adopted expressing the opinion of Conference that the

payment for cane beetles must be considered as being uneconomic as a method of control. Mr. E. H. Fox of Mourilyan described a new form of mechanical injector which he hoped would, when perfected, serve to reduce costs of fumigation in fields infested with cane grubs. The machine was not available for demonstration but Mr. Fox was urged to persist with his experiments. Several speakers stressed the heavy impost of freights on fumigants and it was resolved to ask the Director of the Bureau to approach the Commissioner for Railways and again request a reduction of this charge.

At the 1937 Conference it was suggested that further investigation be made of the possibilities of fumigation as a means of control of the "frenchi" grub pest. Mr. J. H. Buzacott reviewed fumigation experiments carried out last year and indicated that fumigation did not constitute a suitable and economic method of attack (*see* page 8).

Mr. Buzacott also read a paper (*see* page 9) outlining experiments in which a considerable reduction in borer damage had resulted from the systematic trashing of Badila cane. Contrary to expectation this trashing did not increase the hardness of the rind and, apparently, it was the removal of shelter which reduced the borer attack. These experiments are now being extended in order to ascertain the minimum amount of trashing required to get satisfactory control; it will then be possible to determine the economics of this form of control.

Mr. McDougall dealt at length with experiments carried out to determine the comparative deadliness of various rat poisons and the palatability of different baits. Rolled oats appeared to be the most favoured bait among those fed to the field rat, while there was little difference between whole wheat, wheatmeal, corn and cracked corn; barley is not particularly desired while bread is definitely not attractive. Hunger does not appear to make rats any more likely to take unattractive baits. The actual palatability of baits is not improved by the addition of linseed oil but this oil does serve to attract the rats to the bait. Details were furnished regarding the amount of several poisons required to kill rats of standard size. Yellow phosphorus was found to be easily the most deadly; the chief difficulty is the problem of presenting it to the rats in palatable form. Thallium sulphate possesses some desirable characteristics as a poison but it is not particularly highly poisonous and it is considered that when thallium-treated wheat is used as a bait a poison strength of about 1 : 300 should be used.

In dealing with rat populations in the field, Mr. McDougall indicated how the numbers of rats present might be determined with reasonable accuracy and also pointed out that the average body weight of rats trapped was an indication of whether rats were breeding or not. For example, a decreasing average body weight would indicate an increasing proportion of young rats. It was pointed out that there remained a very great deal to be learned regarding habits and natural fluctuation in rat populations in Queensland, and until such knowledge had been gained the value of poisoning campaigns could not be accurately assessed. A normal natural high death rate occurs among field rats towards the end of the year, for example, and this should not be attributed to the result of setting out baits at that time. On the other hand representatives of a number of Pests Boards expressed

their belief that beneficial results were obtained from poison campaigns conducted by them early in the year. Mr. Bell summarised the results of recent interesting investigations in Hawaii regarding the practice of "pre-baiting" fields with non-poisoned bait and then suddenly substituting exactly similar but poisoned bait. It was emphasised that these experiments dealt with a different species of rat, under quite different conditions, but it was thought that these experiments might stimulate further investigation.

Mr. Mungomery, in a paper, drew attention to the sensational but quite unfounded reports concerning unfavourable characteristics of giant toads, which had recently appeared in the Press. The result was that some people had developed a quite unnecessary fear of these toads and would kill them on sight. He demonstrated to the Conference that the toads had to be subjected to harsh treatment before they would exude even a slight amount of a whitish fluid from the glands behind the head. After a discussion of the matter, Conference decided to ask the State authorities to declare the toad a protected animal.

Apprehension was voiced regarding the danger of importing new sugar-cane pests on in-coming overseas aeroplanes, particularly now that a service between New Guinea and Australia had been initiated. Ample evidence was forthcoming that insects could be, and were, introduced in this manner, and it was resolved that the Minister for Agriculture be approached and his aid enlisted in obtaining more stringent quarantine precautions.

On the subject of the wallaby pest the consensus of opinion was that poisoning was unsatisfactory, payment for scalps open to too many abuses, and the most satisfactory method was the erection of wire-netting fences, at least in compact areas.

At the conclusion of proceedings it was decided that the next Conference should be held in Mackay in 1939.

Grub Control in the Burdekin District, 1937-38.*

By H. G. KNUST.

THE following notes on cane grub control in the Lower Burdekin have been compiled from observations made during visits to this district in 1937-38:—

The repeated heavy waterings of cane lands in the Burdekin District does not appear to have any definite effect on the time of emergence of the greyback beetles, as is instanced by the fact that beetles did not emerge until after the copious rains which occurred at the end of last November. Following these rains large emergences occurred in various parts of the district where grub infestation had been great and destruction considerable earlier in the year; emergence occurred from the cultivated lands, and it was not until later rains occurred, in late January and early February, that beetles emerged from the grassed and timbered lands.

* Paper contributed at a Conference of Cane Pests Destruction Boards, held at Meringa, on 25th May, 1938.

Collection of beetles under the Burdekin conditions would, in my opinion, be a very unsatisfactory method of control; feeding trees (Black Palm, Bloodwood, Moreton Bay Ash, and Ti-tree) occur throughout the district and are numerous in the large areas of forest lands within and adjoining the cultivated lands. Under these conditions only a small percentage of the beetles could be collected, and a sufficient number would be left to cause considerable damage. Destruction of any small areas of feeding trees within the cane areas should reduce the grub population adjacent to these areas, but destruction of the larger areas is, I consider, a very big undertaking and may not be beneficial.

Apparently, continued favourable weather conditions have been responsible for a low mortality of grubs and beetles, and this year we find that grub populations per infested acre are high, ranging from an average of 3 to 14 grubs per stool. Fumigation has been practised this year, and the results accruing therefrom should be beneficial.

When fumigating careful supervision has to be maintained for the following reasons:—

1. Some soils appear to hold the moisture longer than others and cracking of the soil occurs, quite soon after rain, in some situations. When cracking occurs water has to be applied to make the soil suitable for fumigation.
2. The water furrows between the rows of cane, and the application of water to these furrows does not force an early concentration of grubs at the base of the stool but rather tends to keep the grubs scattered for a longer period, and the grubs appear to favour the root growth in these furrows.
3. Where grubs concentrate at the base of the stool they feed from 4 to 10 inches below the surface, due to the necessity for heaping soil against the stool to create water furrows and the consequent burying of the stools.

It is my opinion that, with the assistance of the weather conditions peculiar to the Burdekin District, fumigation will considerably reduce the grub-infested areas, but small areas of cane lands immediately adjoining the large areas of forest lands will have to be continually watched and fumigated if necessary.

French's Cane Beetle.*

By J. H. BUZACOTT.

AT the end of last year some consideration was given to fumigation as a means for controlling grubs of the cane beetle *Lepidiota frenchi*. Observational plots were established on a neighbouring farm in order to determine whether economic results might be obtained by the use of the following fumigants:—Carbon disulphide, carbon disulphide + para-dichlorbenzene (1:1 mixture), and carbon disulphide + ortho-dichlorbenzene (2:1 mixture).

* Paper contributed at a Conference of Cane Pests Destruction Boards, held at Meringa, on 25th May, 1938.

At the time of fumigation the grubs had already caused severe damage in patches throughout the block of cane. Rows were selected where the cane was wilted but not dead. The standard dose of 4-6 ccs. was used, and four injections were made at each stool placed approximately 6 inches deep in the soil, which was very dry at the time.

Fumigation was carried out on the 22nd November. On 1st December considerable wilting of heart leaves had occurred in stools treated with ortho-dichlor and para-dichlor mixtures, whilst there was no apparent difference between controls and stools treated with carbon disulphide alone. Later inspections showed that the stalks of the orginal stools died out when fumigated with the mixtures, whereas no damage occurred by using carbon disulphide on its own. The stools damaged by the mixtures grew new shoots—that is, they virtually ratooned—but, of course, their growth did not attain that of the undamaged stools in the control and carbon disulphide-fumigated plots.

When examined during April, 1938, it was apparent that no advantage had been gained by the fumigation; the rows fumigated with disulphide looked no better than those which were left as controls, and those fumigated with the mixture were still comparatively stunted. Considering the dryness of the season surprising growth had been made by the grub-damaged cane and, except where the stools had actually been killed by the grubs, they had made an excellent recovery.

Considered from every point of view, fumigation would not appear to be a practicable method for dealing with frenchi grubs. In the first place, it would be necessary to dig the fields before damage commenced to show, in order to determine which portions to fumigate. This would involve digging to a great depth, and even were this done the erratic manner in which frenchi grubs come up from the deeper layers of soil in order to recommence feeding would render fumigation a doubtful proposition. Particularly is this so in a dry year, and it must be borne in mind that it is in dry years that frenchi grubs cause more severe damage. In years with a well-distributed rainfall the cane is able to make roots sufficiently rapidly to withstand the attacks of the grub.

At present the best recommendation seems to be to pay attention to thorough cultivation and not ratoon too long, as ratooning allows the pest to build up large populations.

The Beetle Borer.*

By J. H. BUZACOTT.

DURING the past year further work has been carried out with regard to the control of the cane beetle borer.

A number of trashing trials were established in different localities and observations were made on the effect of artificial trashing of cane on weight, c.c.s., rind-hardness, and borer population. In each trial there was included untrashed cane, cane trashed twice, and cane trashed three times. Trashing was carried out at 2-monthly intervals and was

* Paper contributed at a Conference of Cane Pests Destruction Boards, held at Meringa, 25th May, 1938.

done carefully; this proved costly, but as the experiment was made in order to determine as accurately as possible whether any advantage could be obtained from trashing, it was deemed advisable, at least in these preliminary tests, to make trashing thorough, regardless of cost.

The first trashing was made when stools showed about a foot of cane, and in view of the fact that, at least in the cane trashed three times, there was no accumulation of trash at any time around the stalks, it is not thought that trashing, when carried out on a commercial scale, could yield results equal to these experimental plots.

An increase in weight of trashed cane over untrashed cane was registered in two out of a total of six plots, and no significant difference was recorded for the other four. The two plots in which the increase occurred were both plant cane in which borers were plentiful, and it is believed that the increase in weight was mainly due to the smaller number of borers (and so less borer damage) in the trashed cane.

In all cases there was a smaller borer population in trashed cane than in untrashed. This difference was very marked, and in one of the badly-infested plant cane plots the figures were as follows:—

Untrashed	132,000 borers per acre.
Twice trashed	27,000 borers per acre.
Thrice trashed	12,000 borers per acre.

No significant difference in c.c.s. occurred except in one plot; this was somewhat unexpected, as it was thought that the greater borer damage in untrashed cane would have been responsible for a lowering of the c.c.s. However, it is possible that there would have been a much greater difference in c.c.s. had the plots been harvested later in the season; as it happened, both plots with high borer infestation were harvested early in the year and apparently at that time much deterioration of the cane had not occurred.

Previously, it had generally been supposed that trashing caused a reduction in borer damage by virtue of the fact that exposure to light and the weather caused the cane rind to harden. When rind-hardness tests were made on cane from the various treatments it was therefore somewhat surprising to find that the hardness was unaffected by the removal of trash. This leads one to the assumption that the trash in itself must be the important factor in the infestation of the untrashed cane. Presumably it affords cover for the beetles and possibly also assists them in the act of oviposition.

This experimental work, in general, seems to indicate that where intense borer populations exist some relief may be expected by trashing the cane. It has yet to be proved, however, that trashing the cut but a short time before harvest, as has been the usual practice, will afford much benefit.

A number of varietal trials to determine the comparative resistance of several varieties to borers were carried out during the season. These trials further indicated that Q.2 is highly resistant to borers and emphasised the susceptibility of Badila. The variety Q.10 also showed fair resistance and seems worthy of a trial in borer-affected areas provided that its other tests prove satisfactory. Still further tests with new varieties are in progress now, and the results from these will be obtained during the coming crushing season.

Considerable progress has been made in testing the rind-hardness of varieties, and it is confidently expected that the use of this reading in conjunction with observations on certain habits of the varieties will enable us to forecast the reaction of them to borers and thereby enable us to eliminate many of the trials which take so long to produce results. In the meantime it is necessary to continue with the trials in order to obtain a basis for the correlation of rind-hardness and other factors with the known reaction towards borers.

Fiji and Downy Mildew Diseases.

Cane planted in the Southern districts in January and February of this year will be showing the symptoms of Fiji and downy mildew diseases where cuttings infected with these diseases have been planted. Although farmers may not be able to recognise either disease with absolute certainty they will be able to see that there is *something* wrong with the stunted stools of Fiji disease or the yellowish stools of downy mildew. If any doubt exists a letter or a telephone message to the nearest Experiment Station will bring an inspector.

Neither Fiji disease nor downy mildew spreads to any appreciable extent at this time of the year. Both these diseases seriously menace P.O.J. 2878 in Southern Queensland and farmers are most strongly urged to go through their young cane *now*, make row inspections and dig out any diseased cane. Only by such attention can P.O.J. 2878 be retained.

In the Mackay district downy mildew, if present, should be commencing to show up in autumn-planted cane. Inspections and digging out of diseased stools should be started now and continued at intervals during the dry spring months.

A. F. B.

Protecting Roofs of Farm Buildings.

The galvanized iron roofs of all buildings adjacent to the coast will rapidly deteriorate if not specially protected by painting. The usual preparation employed is iron oxide paint. Though this is effective, it cannot be claimed that it is very attractive in appearance after a year or two, while it is well known that the red colour is highly absorbent of the heat rays of the sun.

Recently it was necessary to treat the roofs of the Experiment Station buildings at Bundaberg, Mackay and Meringa, and it was decided to use as a finishing coat, a specially prepared aluminium paint. As an undercoating, to prevent the development of rust spots which had appeared on many of the roofs, a well-known rust-killing primer was first applied. This was followed by one coat of aluminium paint.

The finished job has proven to be entirely satisfactory, and the highly-reflecting silver surface of the roof ensures a minimum of temperature rise under the action of sunshine while the appearance is also attractive. We will be pleased to supply further particulars of preparations and costs on application either to our Station officers or to the Brisbane office.

H. W. K.

Sheep Grazing and Lamb Raising Trials at Mackay.

By D. L. McBRYDE AND H. W. KERR.

Introduction.

MANY of the Mackay lands have been reduced to a low state of fertility due to continuous cropping to cane over a long period of years, without due attention to the conservation of humus and soil plantfoods generally. So long as cane cultivation is continued as the only form of agriculture, the costly and slow process of fertility building by means of substantial fertilizer applications, combined with the growth of an occasional green manure crop, is the only method at the command of the farmer.

The average cane yield per acre for the district is one of the lowest in Queensland; it varies from about 11 to 15 tons, which is doubtless much below what would be expected having regard for the average climatic conditions under which the crop is produced. If the lands could be restored to even a moderate level of fertility, crops substantially in excess of this could reasonably be anticipated, and costs of production could be reduced proportionately. Now it is a happy circumstance that many of the cane farms of the district are appreciably larger than the net harvestable area, and it would be possible for farmers to adopt a system of crop rotation whereby nature's own remedy of long fallowing under grass could be invoked to rejuvenate the worn-out soils, while allowing of intensive cultivation methods on the area cropped annually to cane.

Planning the Rotation.

The main objection to such a policy is that the land thus thrown out of production would still be subject to rates and taxes, whilst yielding no revenue to the farmer; and it was with the object of demonstrating the value of a well-designed rotation system, combined with some revenue-producing accessory crop, that one block of the Mackay Sugar Experiment Station was set aside, when the new Station site was acquired some three years ago. The block selected was actually a low-lying area, much of which is subject to flooding during periods of heavy rainfall, and on which young cane crops were regularly affected by wireworms as a consequence. When it was brought into the experiment, the block carried a rank growth of para grass (*Panicum muticum*), which proved very difficult to destroy by cultivation methods. The field is 16 acres in area, and it was sub-divided into eight plots, each of approximately 2 acres. It was planned to follow an 8-year rotation; each year two plots would produce a plant and first ratoon crop of cane respectively, while the balance of the area would be under pasture. A well-planned system of surface drainage was necessary, first of all, and considerable difficulty was experienced in eliminating the minor topographical irregularities which had been brought about by previous cultivation methods.

The first plot was planted to cane in 1936, and a moderate application of mixed fertilizer and sulphate of ammonia was given. In 1937 this plot was harvested and ratooned, while the second plot was planted

to cane. During 1938, two plots of cane will be harvested; that carrying the present ratoon crop will later be ploughed out, a green manure crop grown and turned under, and then seeded once more to grasses. Cane will not be planted again on this plot until 1944, following a further green manure crop after the sod has been broken up. The trash from all cane crops will be conserved as a surface mulch and returned to the soil in due course.

Revenue will be derived from the grasslands by the process of stock grazing. This method ensures the best utilization of the grass crop, while the bulk of the plantfood and humus forming materials are voided by the animals, to rot down and enrich the land. During periods of fodder shortage, the use of cane tops or other roughage, supplemented by a modest molasses ration, will both benefit the animals and add further to the potential humus-building residues and soil plantfood reserves.

Fig. 3.—Merino-Corriedale ewes, Mackay Experiment Station.

Sheep were selected as the most suitable stock for the purpose. It had been demonstrated that they would thrive on the coastal lands, though perhaps not on an area so "wet" as that represented by the experimental block under consideration. Furthermore, in small flocks these animals would impose a minimum demand on the time of the canegrower, and could be expected to return a reasonable income from the sale of their wool, and their progeny. A selection of twenty-five young Merino-Corriedale ewes was obtained, and mated with a Romney Marsh ram for the production of good-type crossbred lambs.

Progress Results.

The results of the experiment to date are highly encouraging. The sheep have survived two wet seasons, with intermittent flooding of the block, without ill-effects, and though they have been inspected at frequent intervals, little evidence has been found of internal parasites; an occasional drench has served to maintain them in a healthy state. No serious foot troubles have been observed, and the animals have retained excellent condition throughout.

The first lambs from the cross made rapid progress from the start. The plan is to retain the crossbred ewes for breeding purposes, while slaughtering the wethers for the local trade. The rapid development shown by the lambs may be gauged from the following table recording ages and weights:—

Lamb No.	Age (7/2/38).	Live Weight.		Gain in Weight.
		14/1/38.	7/2/38.	(24-day period).
		Lb.	Lb.	Lb.
61	14 weeks	34	48	14
67	16 weeks	46	58	12
68	16 weeks	47	61	14
69	18 weeks	63	77	14

During this period the ewes and lambs were on natural pasturage only.

Quality of Lambs.

Four wether lambs were slaughtered at ages of 19-20 weeks, and special attention was paid to the quality of the carcases. The live and dressed weights were:—

Live weight.	Dressed weight.
73 lb.	40 lb.
69 lb.	33 lb.
59 lb.	29 lb.
64 lb.	32 lb.

The average dressed weight was just over 50 per cent. on the live weight. Three of the carcases were graded as good average quality, while the fourth was classed as good export grade. It is interesting to note that this was the smallest of the four, and was more strongly of Merino type than the others. The average value of the animals was about 18s. per head.

Comments by consumers on the quality of the cuts were most favourable, and it may be concluded that animals of suitable type can be produced under these conditions. Absence of a regular supply of lambs for the Mackay market makes it difficult to assess probable demands, but doubtless such would follow. At the present time the trade tends to favour an animal dressing to 40 or 45 lb.

Value of Rotation.

It is, of course, too early as yet to draw any conclusions regarding the value of the rotational system on the productivity of the soil. Two of the plots have produced mature crops of cane, while the third is now under young plant cane. Doubtless the plots which are brought under cane in succeeding years will give progressive indications of the benefits to be expected. For the present, one can only say that the experiment shows good prospects of success, and is sufficiently advanced to warrant an expansion of the project by canegrowers of the Mackay district.

Nut Grass Eradication.

NUT grass is a weed found in all cane areas of the State; in some districts it is limited in its distribution, while in others it is widespread. In the sense that economic crops and weeds cannot thrive in the same land, nut grass must be regarded as a pest, though farmers are by no means unanimous that it does any serious injury to their cane crops, even where the land is heavily loaded with "nuts."

Attempts have been made from time to time to control nut grass, and the best means employed to date is the growing of a crop which will smother the grass. Lucerne and pasture crops are examples. But no satisfactory method has yet been devised for land under cultivated crops.

Farmers will doubtless be interested in the results of an experiment which is reported from the United States of America, and in which an attempt has been made to eliminate the weed by *frequent cultivation.* The object was to break apart the tubers and expose them to drying at or near the surface of the soil. Other tubers would be stimulated to germinate, in the moist soil; apparently this takes place only when the individual tubers are broken away from the general plant system. It was further shown, in the particular sandy soil studies, that less than 1 per cent. of the "living" tubers were below plough depth.

Separate plots were selected, and various treatments were tested. Both ploughing with a mouldboard plough (which inverted the slices and facilitated drying out) and harrowing with discs, were employed. The implement used in the latter treatment consisted of 10 discs, each 16 inches in diameter, and the plots were treated twice at each working. Ploughings or discings were made at 1-, 2-, and 4-week intervals from June to October. On other plots, the treatments were made whenever sprouts were general over the area. The average interval in these cases was about three weeks, and operations were continued from April to October.

The results show that over a period of two years, nut grass was either completely eradicated or very nearly so on all plots except those which were disced every four weeks. The infestation was reduced by about 80 per cent. in the first season. Further trials at a later date showed that by ploughing at three-week intervals, over two consecutive seasons, the nut grass was completely eliminated.

It is therefore concluded by the authors that nut grass can be eradicated from sandy soils by the method employed. It is suggested that the method is particularly practicable when small areas of nut grass occur in a field, though it may not be applicable on a farm-wide scale.

Before anticipating similar success under Queensland conditions, it must be borne in mind that the soil type under consideration is important. These experiments were made on light sandy soils, which dry out rapidly. This is an essential feature of the project. Furthermore, the proportion of winter killing of the young nuts which persisted after the first season could not be expected in Queensland; but at least the results are interesting, and the scheme is worthy of trial under selected conditions.

H.W.K.

Mosaic Disease of Sugar-cane.

By C. W. Leece.

MOSAIC disease is one of the most widely spread diseases of sugar-cane in the world, and is one with which canegrowers in Central and Southern Queensland should be familiar. It is, however, a disease which has never received quite the full amount of attention that it deserves from farmers, and consequently it is possible that the losses resulting from it in Queensland are under estimated. In view of its widespread distribution in this State and the cultivation of many susceptible varieties it is desirable that farmers should have an adequate knowledge of the disease, and thus be in position to initiate any necessary control measures.

In many countries overseas, mosaic disease constitutes a major problem and very heavy losses have been recorded. In Puerto Rico in 1920, the sugar industry was threatened with extinction in consequence of the ravages of the disease. The same position arose in Louisiana in the Southern United States about five years later. In the Argentine, the West Indies, and in other countries strict control measures have had to be applied in order to avoid serious losses. In Louisiana the existence of different strains of the disease has been recognised, and a variety resistant to one strain may be susceptible to another, and may vary again in its reaction to a third. It is difficult to say just in which manner these strains arise, and cane breeders in Louisiana have been faced with the problem of breeding varieties resistant to all strains as part of the campaign to control the disease.

In Queensland, mosaic disease is very rarely seen in the wet tropical areas north of Townsville. Infection is, however, distributed throughout the Proserpine, Mackay, Bundaberg, and more southern districts, the most severely affected areas being foothill country and river flats, where secondary spread of the disease is rapid.

Mosaic is a virus disease, as is Fiji disease. The characteristic symptoms exhibited by an infected cane take the form of a mottling of the leaves, due to the formation of pale areas of irregular outline, with the long axis of these areas lying parallel to the midrib of the leaf. They may sometimes approximate to oval shape, but are never sufficiently well defined to allow any other term than "irregular" to be applied. They are distributed all over the leaves, and are usually yellowish-green in colour, but may vary from creamy white to pale green, and are seen in contrast to the normal green of the leaf. Variation in colour and shape of the pale areas depends on the particular variety affected and on other factors. The greatest contrast between light and dark areas is noticed on the youngest leaves, the older leaves having a tendency to become uniform in colour again. There is no marked tendency towards streaking, although large chlorotic areas sometimes run together and give a streaking effect. Because of this apparent streaking mosaic disease was originally termed "yellow stripe" disease, but the latter name was subsequently abandoned on account of the fact that the streaked effect was by no means always a characteristic. Symptoms are usually exhibited by all leaves attached to one particular stalk, and the number of obviously diseased stalks in a stool varies from one to all.

The accompanying illustration shows two diseased leaves, one young and the other an older leaf borne on the same stalk of E.K. 28.

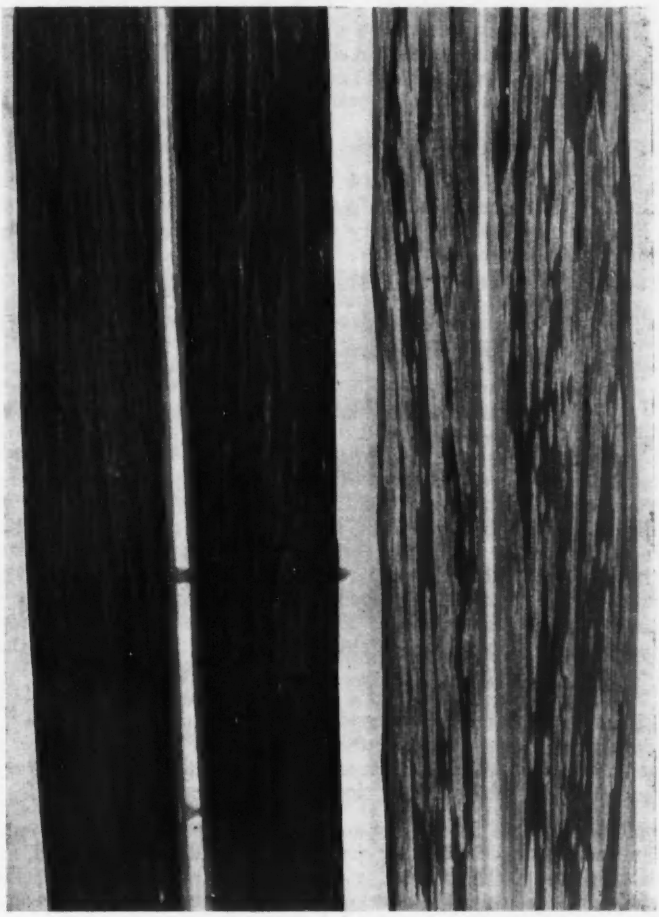

Fig. 4.—Mosaic disease. Leaves of sugar-cane variety E.K. 28 bearing the typical mottling produced by mosaic disease. On the right is a young leaf, and on the left an older leaf, both taken from the same cane stalk.

The effects of the disease vary with the variety, as some varieties are more susceptible than others. If a healthy, growing, cane becomes infected, there may be little diminution in growth, as in the case of P.O.J. 36; on the other hand, if Q. 813 contracts the disease there will be a very marked stunting. In the ratoon crop there will certainly be marked stunting and poor stooling if the variety is by any means susceptible; the stalk will be shorter and thinner, and fewer stalks will be produced in a stool. A mottling similar in pattern to that on the leaves may appear on the rind, and small cankers of various types may

also be present. If a diseased sett is planted a stunted stool results, and this never regains normal vigour. Resistance to adverse conditions such as prolonged dry weather is lowered, and death of the stool may result.

The most susceptible varieties are 1900 Seedling, Clarke's Seedling, M. 189 (Black Innes), E.K. 28, B. 208, and D. 1135. P.O.J. 213 and P.O.J. 234 both contract the disease very readily, but are less sensitive than the firstnamed varieties, and losses are not so great. Badila and Oramboo are also susceptible. Resistant varieties are P.O.J. 2714, P.O.J. 2725, and P.O.J. 2878.

So far, the effect of mosaic on Co. 290 has varied according to locality. A fair amount of infection has been observed in one part of the Mackay area, but the variety appears to be tolerant elsewhere. The existence of different strains of the disease in Louisiana has been mentioned, and it is possible that new strains are beginning to develop in Queensland. It is therefore very desirable that every effort be made to control the disease before any new strains become dominant, and thus add to the complexity of the problem.

The disease is infectious, and is transmitted from plant to plant by the corn aphis, *Aphis maidis*, a small dark insect. This insect is not normally a feeder on cane, and never breeds on it. It is, however, the chief means of transmitting the disease. Experimentalists have succeeded in inducing mechanical infection by placing a diseased leaf above a healthy one and pricking both leaves simultaneously with a needle. A piece of stem tissue taken from a diseased cane has also been used to infect a healthy cane by making a hole in the latter and inserting therein the diseased tissue. Another worker has obtained diseased stools by cutting healthy cane with a knife which has previously been used to cut diseased cane. However, mechanical transmission need not worry the farmer, whose chief concern is the control of the corn aphis.

The corn aphis is most common during the summer and autumn, and it is then that most natural transmission will take place. Since young canes are more easily infected than older ones, the young spring plant cane is in a condition favourable for contracting the disease just at the time when the aphis is most plentiful.

Mosaic disease is not confined to sugar-cane. Maize, sorghum, Sudan grass, and certain other grasses, both wild and cultivated, are also liable to contract the disease, and thus act as a source of infection for canefields. Moreover, the corn plant is a natural breeding ground for the insect, and it is therefore inadvisable to have corn and cane growing in close proximity to each other.

Since losses due to mosaic disease may be of considerable importance if the disease is allowed to remain unchecked, the farmer is recommended to utilise the following methods of control:—

(1) Make regular inspections of fields, following these by digging out diseased stools.

(2) Select planting material carefully, using only those plants taken from disease-free stools.

(3) Keep all headlands and fields as clean as possible, and free from weeds and grasses, which are also liable to harbour the disease and the corn aphis, which spreads it.

(4) Avoid the cultivation of maize and sorghum. If it is necessary to cultivate these crops isolate the blocks as much as possible. The corn aphis is unable to breed on sugar-cane but multiplies very rapidly on the maize plant.

(5) Carry out planting operations in the autumn where practicable, rather than in the spring. The corn aphis is most common during the summer and autumn, and the young spring plant cane constitutes ideal material for infection.

(6) Cultivate resistant varieties if other control measures fail to keep the present varieties reasonably free from disease.

Cane Samples for Test Purposes at Experiment Stations.

Attention has been drawn on several occasions to the conditions which must be observed by canegrowers desirous of having cane sample tests made by our Experiment Stations, for the purpose of determining the state of maturity of their crops, and thus giving an indication of the sequence in which respective blocks should be harvested.

Each sample shall consist of six stalks or 20 lb. of cane, whichever is the greater. Samples of burnt cane will not be accepted in any circumstances. When samples are forwarded over the railway, freights must be paid. By special arrangement with the Railway Department, test canes are consigned at a flat rate of 1s. per bundle. Where facilities for prepayment of freight are not provided, the grower should reimburse the Experiment Station by forwarding 1s. in postage stamps, enclosed in a brief letter advising that the canes have gone forward.

It should not be necessary to point out that the results of our Station tests are never intended for use in checking mill returns; for this purpose they are quite misleading and worthless.

H.W.K.

An Experiment in Soaking of Cane Plants.

By N. J. KING.

THE subject of plant soaking prior to planting has received considerable attention at different times and in various sugar countries of the world. Experiments have been carried out with the soaking of plants for periods from twelve to forty-eight hours in water and in solutions of lime, magnesium sulphate, and other compounds. Results have not always been conclusive, and frequently they have been almost contradictory. But when one considers the variety of conditions obtaining in sugar countries on opposite sides of the globe, some inconsistencies are to be expected. Factors which may have effect on the results of plant soaking would include (1) age of cane plants, (2) succulence of the plants, (3) moisture content of the soil, (4) state of advancement of buds, and (5) possibly the cane variety.

For years it has been the general practice on the Bundaberg Experiment Station to soak cane plants. Soils are usually dry for spring planting, and frequently so for autumn planting. In many

cases the plants also are lacking in succulence at this time of the year, and it was inferred that the soaking and absorption of water would enable the plant to germinate more quickly.

During the spring of 1937 we received at the Bundaberg Experiment Station 109 points of rain on 27th August. We were just ready to plant and were forced to delay operations until the 30th August, as the land was too wet for the drill plough. The plants were just eleven months old irrigated cane, full of growth, and very succulent. Under these conditions of optimum soil moisture and young soft plants one might not consider that any advantage would accrue from soaking in water. However, the plants for the first day's planting were soaked from 5 p.m. to 8 a.m., taken to the field and planted in the moist soil. For the next day's planting on the same block, the plants came from the same source but were not soaked. In this case the plants were just bagged and stacked overnight. The accompanying photograph shows the difference in germination a month after planting. The cane on the left of the photograph is from soaked plants, while that on the right is from unsoaked plants.

Fig. 5.—Showing effect of soaking plants under conditions of perfect soil moisture. Rows on left of photograph planted with soaked plants, on right unsoaked plants.

Whether such a remarkable difference would result under all conditions in Bundaberg is doubtful, but it would appear that at least some improvement could be expected.

The unsoaked section did germinate ultimately and gave just as good a strike as the soaked section, but the advantage is that the soaked section got away to an early start and retained its lead.

A word of warning should be issued in respect of soaking cane plants when planting susceptible varieties in localities where gumming and/or leaf-scald are present; under such conditions the soaking of plants could serve to spread the disease, and the practice is to be discouraged.

Need for Lime on Acid Soils.

It is evident that many canegrowers still fail to grasp the necessity for applying adequate dressings of lime to those lands which are intensely acid. Under these conditions, the benefits of artificial manures will not be obtained until the acids have been neutralized or "killed" by lime.

We are forcibly reminded of this by the results of nine soil samples submitted to our laboratory recently by the Instructor in Cane Culture at Innisfail. Each was taken from a field where crop growth was poor, and in all cases our tests showed that the soils were in need of heavy applications of lime. In many instances the plantfood supply of the land was quite fair, but the acid condition of the soil dominated the growing conditions.

Canegrowers in the heavy rainfall areas—from Mossman to Ingham—and notably those farming other than red volcanic soil, should communicate with their local Instructor in Cane Culture for the purpose of having tests made: or a sample representative of each block to 10 in. depth may be sent, to the Director, Bureau of Sugar Experiment Stations, Brisbane. This service is given free of charge.

H.W.K.

A New Green Manure Crop.

By N. J. KING.

DURING November, 1931, seeds of several green manure crops were received in small quantities from the Council for Scientific and Industrial Research, and were planted out on the Bundaberg Experiment Station. From these only one, *Crotolaria goreensis*, has survived several trials, and is considered to be of sufficient value to justify a short note on its performance. The several varieties were planted here on 2nd December, 1931, and it says much for the hardiness of *C. goreensis* that it was the only one to withstand the drought which began in January, 1932. During these severe drought conditions the rainfalls at the Station were—January, 1·62 in.; February, 0·27 in.; March, 0·10 in.; April, 1·75 in.

Seed was collected from the crop and was replanted in the spring of 1932 and again seed was collected. Since that time several sowings have been made on a small scale and seed has been supplied to the Queensland Acclimatisation Society and for distribution to the pine-apple growers of coastal South Queensland for use as an inter-row crop for humus production.

C. goreensis is a small-leafed, upright, branching plant. It does not lie down or run along the ground and does not possess runners similar to the cowpeas and Mauritius beans. It appears to be a hot weather grower, not developing much growth before late November in Bundaberg and making most prolific growth from December to March. It is definitely a long fallow cover crop. Planted in spring it will not flower before April, and mature seed is not obtained from the plant prior to late April or early May. On account of its upright habit it is

easy to plough in, no vines being present to impede the work of the plough. The seed is flat and kidney shaped and about one-eighth of an inch in length. The crop will seed very prolifically if allowed to do so. The small size of the seed allows of an acre being planted thickly with 10 lb. of seed. Germination is sometimes irregular, possibly due to the picking or sowing of immature seed.

The advantage of such a crop over Poona pea is that where land is being prepared for spring planting the *C. goreensis* provides a much longer cover crop without danger of seeding and consequent volunteer plants in the cultivation. Poona pea must be ploughed in in January to avoid seeding and volunteer crops. *C. goreensis* can be left to take full advantage of the wet season, produce a much larger crop thereby, and then be ploughed in during April when soil conditions are usually sufficiently dry to enable uninterrupted ploughing to be carried out.

Insofar as North Queensland is concerned Poona pea is not an ideal green crop. The ploughing-in period is the wet season, and if rains prevent this the crop may seed and produce troublesome volunteers in the subsequent cane crop. Since a long fallow crop would be a definite advantage in those areas some small plantings of *C. goreensis* are being made to test its suitability to North Queensland conditions.

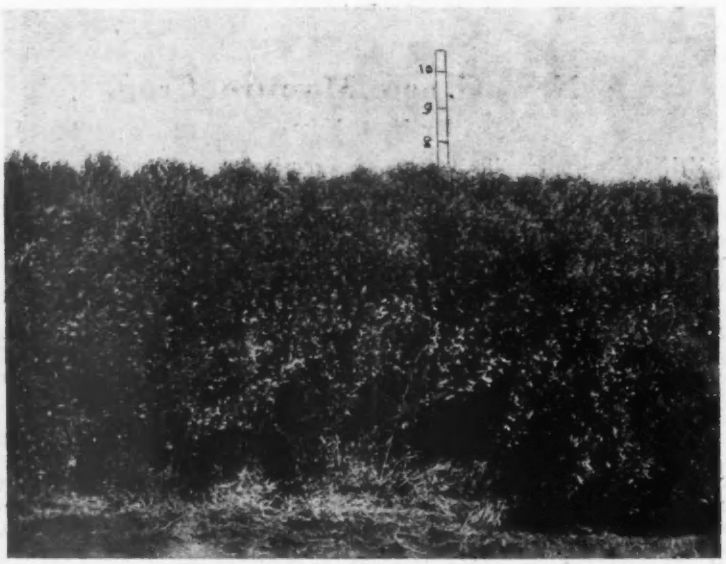

Fig. 6.—A crop of *Crotolaria goreensis*, 7 ft. 6 in. high, growing on the Bundaberg Experiment Station.

As regards mass of foliage the crop is quite satisfactory. The crop illustrated was 7 ft. 6 in. high in May, 1938, just at time of flowering. It was desired to collect seed from this crop, so it was allowed to stand. In June a section 10 ft. x 10 ft. was cut out and weighed, and the weight calculated at 15·8 tons per acre. By this time, however, much

of the leaf had fallen owing to seeding and the stems had become woody and lighter than in the younger stage.

The nitrogen content of the plant was 2·18 per cent. on the dry material. Estimating the moisture content of the plant at 75 per cent. this crop would return to the soil nitrogen equivalent to 905 lb. of sulphate of ammonia per acre.

Some of the crotolarias have been reported as being poisonous to stock. There is no evidence that this variety is in any way harmful.

Special Fertilizer Mixtures for Sugar Cane.

By H. W. KERR.

THE number of possible fertilizer mixtures which could be manufactured is without limit; and, indeed, the number of mixtures actually marketed in Queensland to-day is so great that the farmer can only become confused by the range and selection available.

Some four years ago, this situation was reviewed for the benefit of canegrowers, and a small selection of mixtures was made, with the object of framing all future recommendations on this basis exclusively. Only two plantfood materials—phosphate and potash—were considered in this respect. It was felt that applications of the third plantfood—nitrogen—could well be regarded as a separate factor, to be introduced as required. It was therefore possible to restrict the mixtures to three, which contained—

No. 1.—High phosphate, low potash.
No. 2.—Medium phosphate, medium potash.
No. 3.—Low phosphate, high potash.

By applying a suitable dressing of the appropriate mixture, the farmer could provide his plant cane with its full requirements of phosphate and potash in one application. The need for nitrogen for the plant crop would be governed by such considerations as whether a green manure crop had been ploughed under during the preceding fallow, or whether it was a "plough-out and replant." Such treatment would take the form of top-dressings of sulphate of ammonia, applied to the crop when the land was free of weeds, and the roots of the young crop were ready to absorb it without delay. This is generally in the spring of the year.

Now ratoon crops are always in greater need of nitrogen than plant cane, irrespective of the area or the farming rotation followed. It was therefore considered desirable to devise "ratooning" mixtures corresponding to the "planting" mixtures already discussed; the main difference then between No. 1 plant and ratooning mixtures, for example, would be the addition of sufficient sulphate of ammonia to supply 3 per cent. of nitrogen, to give a rapid start to the young ratoon crop.

We have, then, six actual mixtures in the Sugar Bureau series, and the respective compositions are shown in Table I.

TABLE I*.—COMPOSITION OF SUGAR BUREAU FERTILIZER MIXTURES.

Mixture.	Nitrogen.		Phosphoric Acid.		Potash (as muriate).
	As sulphate of ammonia.	As bone and offal	As super.	As bone and offal.	
	%	%	%	%	%
No. 1 Planting	..	1·0	13·0	4·0	7·5
No. 1 Ratooning	3·0	1·25	9·5	3·5	6·25
No. 2 Planting	..	1·25	9·0	3·75	15·0
No. 2 Ratooning	3·0	1·25	7·0	3·75	12·5
No. 3 Planting	..	1·75	2·5	5·5	25·0
No. 3 Ratooning	3·0	1·5	2·0	4·5	22·5

It should be stressed that these mixtures provide for the requirements of even the most discriminating canegrower, and nothing is to be gained by going outside this range. Furthermore, as all Bureau recommendations, following soil analyses, are made on the basis of these mixtures, the canegrower would be well advised to "get the habit" of adopting the Sugar Bureau mixture best suited for his soil. It will be either No. 1, No. 2, or No. 3—using the planting mixture for plant cane, and the ratooning mixture for ratoons.

The best index to the precise needs of any soil type is an analysis of the soil from the particular field; and growers are again urged to take advantage of this assistance, for which there is no special charge. Indeed, the Instructor in Cane Culture will take the samples and despatch them, on request. In the absence of this information, however, the farmer may accept the following general recommendations, on the broad basis of soil type:—

No. 1 *Mixtures.*—Generally suitable for lands deficient in phosphates. Such are the alluvials and forest soils of most areas.

No. 2 *Mixtures.*—Suitable for those lands generally deficient in both phosphate and potash. The red schist soils of North Queensland, or alluvial and forest lands on which meatworks fertilizer only has been used, are examples of this class.

No. 3 *Mixtures.*—These are specially compounded for use on soils showing marked potash deficiency. The red volcanic loams of all cane areas are the best examples of this class.

As a very general recommendation, these mixtures should be applied at the rate of 4-5 cwt. per acre. For poor soils (sandy loams, &c.) the dressing might be increased to 6 or 8 cwt. per acre, while on the rich alluvials of the Burdekin area, 3 cwt. per acre would suffice.

*It should be pointed out that these analyses represent the *actual* composition of the mixtures as prepared by reputable fertilizer companies. The guarantee printed on the bag labels may, however, show figures slightly lower than those of this table. The explanation lies in the fact that such companies are protecting themselves in the (unlikely) event of a particular batch of mixture not measuring up to the full standard as set out, which would render them liable to prosecution under the Fertilisers Act.

It should be noted carefully that, except for a small proportion in the ratooning mixtures, this series supplies virtually no nitrogen to the cane. It is now well recognised that nitrogen is generally the plant-food most seriously lacking in Queensland cane soils. The farmer must therefore utilise sulphate of ammonia in addition to these mixtures, to provide a "balanced" treatment.

Except where green manuring has been practised before planting, plant cane will usually benefit from a top-dressing of sulphate of ammonia at the rate of 2-3 cwt. per acre. Ratoons will always demand more nitrogen than plant cane, and such crops should invariably be top-dressed with sulphate of ammonia. Usually 3-4 cwt. per acre is sufficient, applied in two dressings; ratoons under irrigated conditions may, however, require up to 5 cwt. per acre.

Bundaberg Field Day, 29th June, 1938.

Address by H. W. KERR, Director.

IT is my pleasure once again, to welcome to our Experiment Station a group of Southern Queensland cane growers; this is an annual occasion when we invite you as a body, to inspect our Station, to learn what we are doing here, and to let our officers have your views on problems of importance to sugar cane agriculture. We are also pleased to welcome mill executives and officers and representatives of organisations who are vitally interested in the welfare of the industry. I trust that in the course of your brief stay you will find something of interest and value in the work we are attempting here.

It is pleasing to note the vast change which has come over the district since we met a year ago; at that time the crop was suffering from the effects of droughty conditions, but to-day we see something indicative of what the district is capable, provided it receives its share of nature's beauty. It causes one to pause and speculate just what would happen, under our present high standard of agriculture and with our improved cane varieties, if we were to experience the "perfect" season! I venture to suggest that the mills of the area could be supplied with cane at a more rapid rate than they could treat it, if they were to crush continuously.

Such a thought is rather disturbing, paradoxical though this may sound; and although it is not our purpose to dwell on this phase of economics to-day, it is one which should seriously engage the attention of the industry. As an Experiment Station it is our duty to assist the canegrower in dealing with the complementary phase of production —that of the costs of producing one ton of cane. We must leave it to the good sense of the canegrower to decide whether he should grow 10, 50, or 100 acres, or whether he should adopt irrigation practice as the only reliable means of regulating crop production.

The major problem of this district some ten years ago was gumming disease; with the guidance of the Bureau we are pleased to say that the district has taken a new lease of life, mainly through the introduction of new cane varieties which were highly resistant to that disease. But once again the horizon is darkened by the spectre of other diseases, which threaten the new canes just as seriously. I will not enlarge on this subject; Mr. Bell will have some important comments and advice

to present in the course of his remarks. But I would emphasise that the growers of all Southern cane areas are at the present time faced with the necessity for deciding without delay, whether they are prepared to make a concerted effort to deal with this problem before it assumes serious proportions, or whether the position will be allowed to drift until they find themselves obliged to fall back on the old inferior cane varieties, which almost resulted in the elimination of the industry in these parts. I feel, however, that they will one and all appreciate the wisdom of the advice which Mr. Bell has to offer; we are prepared to do our part, but it must be realised that we are powerless without the full co-operation of the farmers.

We are not attempting to paint a gloomy picture of the future; on the contrary we feel confident that the day is not far distant when we will probably have new cane varieties of our own breeding which will combine the qualities of yielding capacity and sugar content, with resistance to all major diseases. In the course of our tour of inspection you will be afforded an opportunity of inspecting some of the more promising varieties we have produced to date. But at the same time we must not build castles in the air; and until the worth of such new varieties has been adequately demonstrated, we would be ill-advised to forsake the substance for the shadow; for the present, then, the valuable P.O.J. varieties should be guarded at all costs.

Since our last field day, you will observe that we have acquired a hothouse to facilitate the cane seedling work, which is now one of the most important phases of our Station duties. Our officers will explain the methods, and demonstrate the equipment employed. You will also see the fully grown seedlings planted in the field last spring as well as the best varieties selected from previous years.

In our field trial work we have recently effected a transition from the short range experiments, which extend through a plant and one or two ratoon crops, to the long range trial, in which carefully selected treatments will be repeated continuously for a long period of years, in order that we may determine the cumulative effects of those practices which we are recommending. The first of these trials was the Trash Experiment which has now been in progress for 5 years. To date, the benefits of conserving all trash *versus* burning all crop residues after harvest have not been pronounced; but we should have visible evidence of this improvement in the near future, if the benefits we anticipate are to be realised.

Much has been said lately of the value of crop rotation in promoting better soil conditions for cane growth. A very interesting experiment which has just been instituted is that in which long *versus* short fallowing, with green manure crops, will be thoroughly tested as a means of restoring the older soils to something approaching their virgin fertility. With recent trends towards increased cane tonnages per acre, and consistent production of excess sugar, the farmer should be eager to adopt some means of making it still easier to pursue methods of intensive production on a reduced area cultivated, while allowing the balance of the farm to remain under green manure cover for an extended period. It is just one step from such practice, to the adoption of some form of stock fattening, which I have repeatedly urged as a means of deriving revenue from the land which could thus be released from cane cultivation. The animals could be fattened on

the succulent leguminous crops produced, without depriving the land of any of the benefits to be expected from the green crop. Indeed, the process could be intensified by feeding cane tops, with a moderate ration of molasses, to be converted into valuable farmyard manure by the animals and thus enrich the soil still further.

During the past year we were able to demonstrate the definite value of a species of crotolaria which had been grown here formerly, but which was temporarily kept in reserve in order that we could assure ourselves that it would not become a pest. The species is very definitely drought resistant, and it possesses the virtue of an extended growing period which makes it suitable for long fallow purposes. The 1937-38 crop attained a height of 7 ft. 6 in. before it was ploughed under, and despite the heavy loss of leaf which occurred at seeding time, the yield of green matter was almost 16 tons per acre. Such a weight of leguminous crop, with roots well nodulated, would be equal in value to at least two good crops of Poona pea.

Though you are all fully acquainted with the results which arise from irrigation on the red volcanic loam, I must draw your attention to the ratoon crop which will be seen early in the course of our station tour. This field was harvested late in the season, following which it received two early waterings and appropriate fertilizer dressings; in the course of six or eight weeks the ratoons were virtually out of hand, and though no water has been applied in the form of irrigation since December, the crop will evoke the admiration of any farmer with an appraising eye for a successful ratoon. The amount of cultivation required by such a crop is an absolute minimum, and the savings in this respect would probably outweigh the cost of water and its application.

I will not detain you further with details of the Station and its work; you have come here to see for yourselves and ask questions about any matters on which you desire advice or information. We have with us other speakers who have matters of importance to place before you and discuss. But before concluding my remarks, I would request all visitors to refrain from removing any small souvenirs from the Station in the shape of cane. We would gladly favour any farmer with anything we think would be of benefit to him; but remembering that we are not far removed from sources of infection of Fiji and downy mildew disease, please do not embarrass us later by proving us guilty of being the unwitting cause of your now clean farm acquiring its infection.

P.O.J. 2878 in Southern Queensland—Can it be Retained?*

By ARTHUR F. BELL.

IN addressing you as head of the Division of Entomology and Pathology, I am thankful to be able to say that the damage caused by insect pests in the Bundaberg district remains very slight. A slightly increased amount of damage, due to the Childers cane grub, has appeared with the extension of two-year cropping. Mr. Mungomery, who has had a

* Address delivered at the Farmers' Field Day, Bundaberg Sugar Experiment Station, 29th June, 1938.

great deal of experience with this pest, paid a visit to the Bundaberg-Isis district during February and March. He recommends that grub-infested ratoons should not be stood over, and strongly deprecates the practice of "plough-out and replant." In particular he commends for your consideration the more widespread use of high-speed rotary hoes. These implements, used in the summer months, when the grubs are near the surface of the ground, effect a large-scale reduction in grub populations and allow subsequently planted cane to get off to a clean start which should be maintained through to the second ratoon crop. In connection with this pest, I would refer you to an article by Mr. Mungomery which will appear in the July Quarterly Bulletin.*

When we come to the subject of diseases, however, it is a different story. This district has suffered so much from the effects of sugar-cane diseases in the immediate past that it is absolutely astounding to note the apathy displayed by some farmers towards Fiji and downy mildew diseases. On the other hand it is very gratifying to know that your elected representatives are fully alive to the dangers of the present disease situation, and we would like to place on record our great appreciation of the interest shown and the assistance rendered by your District Executive and the Secretary, Mr. Wheeler.

There should be no need for me to point out the good qualities of P.O.J. 2878; you have all seen thousands of acres in this district and know what a great part it has played in helping you out of the slough of despair in which, some ten years ago, the industry in this district was sunk.

Probably most farmers know that P.O.J. 2878 contains one-eighth "wild blood"; that is to say its great grandfather was a so-called wild cane, a thin, hardy, strong rooting and strong stooling cane which contains no sugar whatever. It is from this great grandparent that P.O.J. 2878 has inherited its vigorous growth, strong rooting system, strong ratooning, upright habit, drought resistance, ability to stand over, and also its resistance to gumming and mosaic diseases. However, we know from the bitter school of experience that there is no rose without its accompanying thorn, and in this case the catch lies in the fact that P.O.J. 2878 is highly susceptible to Fiji and downy mildew diseases. But it must be emphasised, and re-emphasised, that at this stage of development of these two diseases in the Bundaberg district it would be an easy matter to control both diseases completely, *provided a little care is constantly exercised by all sections of the cane-growing community.*

We have here, displayed for your inspection, specimens of both Fiji and downy mildew diseases, and I would urge you to take advantage of this opportunity of putting yourselves into the position of being able to recognize these diseases when you see them. But even if a farmer is not able to recognize them I think all will admit that in any case, when confronted in the field with stools such as these, he must know that *something* is wrong with the cane.

Now as to the control of these diseases. Both are spread almost entirely during the summer and autumn months, Fiji disease by the sap-sucking sugar-cane leaf hopper, and downy mildew by means of fungus spores or "seeds" which are borne on the under-surface of diseased leaves, and which blow or splash on to healthy canes. In the case of Fiji disease, the leaf hoppers are very numerous in the summer

* See p. 1.

and early autumn, but die out and become very scarce in the winter and spring; consequently there is very little spread during the latter period. The leaf-hopper, passing from a diseased to a healthy plant, infects it by injecting diseased sap, but it takes weeks and sometimes many months before the disease shows up. In the case of downy mildew the spores of the fungus are produced in greatest numbers during warm, moist weather. Healthy plants become infected through the spores falling upon the young buds in the stalk and germinating and growing into the bud; again it may be months before the disease becomes apparent.

The likelihood of a long period elapsing before symptoms show up in diseased plants makes plant selection very difficult, and to be safe no cane should be used for plants if growing within a quarter of a mile of a single stool affected with either disease. You will now appreciate the dangers which attach to getting plants off another farm, and we cannot sufficiently condemn the practice of buying plants from the four points of the compass. In the first instance both these diseases are spread from district to district, and to a great extent from farm to farm, by the use of infected planting material. Therefore, farmers should plan as far as possible to grow their own plants, in special plots if need be, but, if it is absolutely necessary to get plants from an outside source, then the assistance of Bureau officers should be called in.

The second point in control is that farmers should carefully inspect their young plant and ratoon cane and dig out and destroy any suspicious stools. If this practice is conscientiously followed by every farmer, then both Fiji and downy mildew diseases can be kept down to insignificant proportions and P.O.J. 2878 saved for the future. But this work must be done at the right time and not postponed until January or February.

Where fields of mature cane are already infected they should be burnt before harvesting and *cut early*. When cane becomes infected during growth it may take some time for the disease to penetrate down to the roots, and therefore the sooner the cane is cut the more likely are the ratoons to come away healthy.

Particular care should be taken in the inspections of ratoons when the previous crop was known to be diseased, but, if infection is above, say, one-half per cent. the cane should be ploughed out without further question.

P.O.J. 2878 is highly susceptible to both these diseases. P.O.J. 213 and Co. 290 are both highly resistant to Fiji disease, but both, and especially P.O.J. 213, are susceptible to downy mildew. Therefore, if P.O.J. 2878 is allowed to become infected with downy mildew it will menace these two varieties also.

We sincerely trust that no farmer will be deluded into thinking that we are making a great deal of fuss about a little matter. We have already been forced to prohibit the growth of P.O.J. 2878 in the Lower Burdekin and Mackay districts on account of downy mildow, and we have also prohibited its growth in the Maryborough and Beenleigh districts on account of Fiji disease. Thus it will be seen that its further cultivation in the Bundaberg district is menaced on two counts.

I have just returned from a visit to the Richmond River district of New South Wales. Ten years ago this district was in the same position as Bundaberg, the sugar industry being in a very parlous condition as a result of the ravages of gumming disease. In the last few years,

due entirely to the introduction of P.O.J. 2878, the situation has been completely transformed and the district has moved to prosperity and record crops. Unfortunately, Fiji disease had been in the district for many years and, at the time of the introduction of P.O.J. 2878, was rather more widespread than it is in Bundaberg at the present time (but not worse than the situation will be in Bundaberg in a year or two if adequate steps are not taken). As a result the retreat has now commenced, and already the planting of P.O.J. 2878 has had to be abandoned in certain areas and less attractive varieties substituted. Realising the outstanding value of P.O.J. 2878, the Colonial Sugar Refining Company is making strenuous efforts to save this cane, but of course the success of the campaign, there as here, will depend upon the vigilance of the farmers.

It is a very serious problem which confronts you, gentlemen. We, for our part, are collecting and trying out all available disease resistant canes, but we have nothing in sight which could adequately replace P.O.J. 2878—and even if we had such a variety, it would necessarily be some years before it could be planted to the large areas now occupied by P.O.J. 2878. The job in hand calls for action right now, and, if you have not already done so, I trust that you will all commence a careful inspection of your autumn plant cane to-morrow morning.

Downy Mildew Disease.

By A. F. Bell.

DOWNY mildew, together with Fiji disease, constitutes the chief menace to the cultivation of the high-yielding P.O.J. canes. It is a very destructive disease and cane farmers who grow P.O.J. canes, B.147 or B.208, should always be on the watch for it.

The early symptoms of downy mildew consist in the production of long yellowish stripes on the leaves and hence the name "leaf stripe" has often been applied to this disease. Stripes vary in width, from fine lines up to about ¼ inch, but individual stripes are uniform in width. Later the stripes turn reddish and the leaves die prematurely. On the under surface of such leaves will be found a white powdery "mildew." These stripes and the mildew are illustrated in Fig. 7.

Sometimes, and especially in young cane, the whole top may be yellowish. The white mildew may not always be found on the leaves and, indeed, may be difficult to find in the dry winter and early spring months.

During the winter a certain proportion of the diseased stalks suddenly elongate and grow up a couple of feet above their neighbours. These stalks are usually thin, soft, and brittle. Kanakas used to call this stage of the disease "jump-up" disease. They stand out like flags pointing to the presence of the disease.

The white mildew consists of countless numbers of the spores or "seeds" of the fungus which causes the disease. These spores fall on the eyes or buds of adjacent canes and, in wet weather, they may germinate and infect these buds. Naturally the plant will not appear infected until the fungus has grown up through the stalk and into the leaves. It very often happens therefore that certain buds of a cane

stalk may be diseased, although the top appears healthy. It will be readily understood then that it is impossible to be certain of selecting healthy plants when there is a diseased stool in the vicinity.

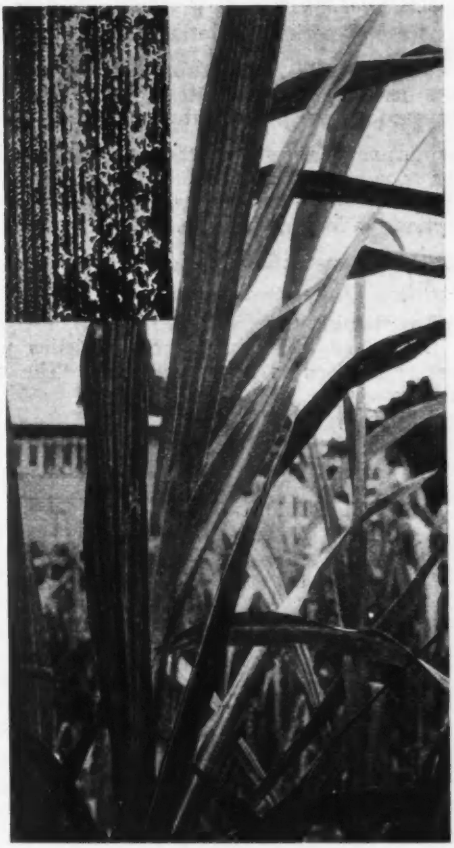

Fig. 7.—DOWNY MILDEW.

Leaves of cane plants affected with this disease bear well-defined, long, yellow stripes; occasionally the leaves may be completely yellowish. On the under surface of diseased leaves may be borne (especially in wet weather) a powdery white fungus or "mildew." This figure illustrates the leaf stripes while the appearance of the mildew (magnified) is illustrated in the inset.

Downy mildew spreads but slowly, if at all, during the cool dry months of winter and early spring. Obviously then the time to effect a "clean-up" on a farm is in the young plant and ratoon cane, before the rains commence.

The following methods are advocated for the control of downy mildew:—

1. Inspect cane and carefully examine any stools or shoots which appear stunted or yellowish or which bear yellow leaf stripes.
2. If there is any doubt as to the disease report the matter to the nearest Experiment Station or Field Officer.
3. Do not take plants from within 200 yards of the nearest known disease. Inspect not only the field from which it is proposed to take plants but also adjacent fields.
4. Inspect autumn plant cane immediately and spring plant and ratoon cane as soon as it is knee high. Dig out and destroy any diseased stools as soon as they are observed. Continue inspections as long as possible.
5. Do not plant susceptible varieties near a known diseased field.
6. Exercise particular care with P.O.J. 2878, P.O.J. 2714, P.O.J. 213, B.208 and B.147, but most varieties will take this disease if exposed to heavy infection. The variety P.O.J. 2725 is resistant.

DAVID WHYTE, Government Printer, Brisbane.

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